

REMARKS

Claims 1-29, 31, 33-35, 37-39, 41 and 42 remain pending. Claims 1-27 and 42 were previously withdrawn from consideration. No amendments were made by this response. Reconsideration of the claims in view of the detailed response below is respectfully requested.

With regard to the objections and rejections of the previously-made drawing changes and specification amendments, a detailed response traversing such objections/rejections of each and every specific change is respectfully provided below. The remaining prior art rejections under 35 U.S.C. §103 are also respectfully traversed in detail below.

The Drawings:

(A) Figures 3 and 4

The Office Action alleged that correcting Figures 3 and 4 to change N<sub>2</sub>O to H<sub>2</sub>O constituted new matter because it is not completely supported in the original Specification. The Office Action further explains that page 15 discusses the use of N<sub>2</sub>O as a source gas, and therefore "it is conceivable that the figures were intending to show residual source gases."

The Applicants submit that the correction to Figures 3 and 4, changing N<sub>2</sub>O to H<sub>2</sub>O, is supported in the original Specification and does not constitute new matter. The allegation that Figures 3 and 4 were intending to also show N<sub>2</sub>O as a residual source gas is not a reasonable interpretation of the disclosures of the present application. In fact, such an interpretation contradicts the bulk of the description emphasizing that the Figures 3-14 are TDS (Thermal Desorption Spectroscopy) drawings that show the content of H<sub>2</sub>O and OH released from the SiO<sub>2</sub> film. *See, e.g.*,

page 14, lines 33 - 37; page 15, lines 14 - 19, 24 - 29, and 34 - 37; page 16, lines 39 - 31; as well as similar discussions in the specification regarding H<sub>2</sub>O and OH content shown in the TDS drawings of Figures 5 - 13. Accordingly, the objections and rejections of the changes to Figures 3 and 4 at item 1A on page 2 and item 2B on page 3 of the Office Action should be withdrawn.

(B) Q and Pm in Figures 3 - 13

Corrections to Figures 3 - 13 regarding the vertical axis were alleged to constitute new matter. The drawings were also objected for not defining or describing the terms Q and Pm.

It should be noted that the terms Q and Pm were also notoriously well known in the art and need not be described in the specification. Nevertheless, it is submitted that changing Figures 3 - 13 to label the vertical axis "partial pressure of the released species in terms of Torr," do not constitute new matter. Support in the original specification for this change appears at page 15, lines 21 - 23. No ambiguity exists. For at least this reason, the objection and rejection of the proposed changes to Figures 3 - 13, regarding the terms Q and Pm, set forth at item 1B on page 2 and item 2A on page 3 of the Office Action should be withdrawn.

(C) Overlapping Plot Lines

Item 2C on page 3 of the Office Action continued to require correction to the plot lines of the drawings (Figures 3 - 14). In the previous response, the Applicant attempted to highlight the relevant sections of the plots for the benefit of the Examiner's understanding. However, it is submitted that correction to the drawings regarding extraneous plot lines, sometimes crossing and

overlapping, is **not** "essential for a proper understanding of the disclosed invention." MPEP §608.02(d).

The description of the drawings emphasize the portion of the TDS analysis pertaining to the content of H<sub>2</sub>O and OH released from the S<sub>i</sub>O<sub>2</sub> film as a result of the heating by a mass spectroscopy while heating the substrate in the temperature range illustrated in the drawings (*see e.g.*, page 14, lines 33 - 37, and page 15, lines 14 - 19). With regard to each of Figures 3 - 13, the original Specification emphasizes the portions thereof pertaining to the quantities of H<sub>2</sub>O and OH (*see e.g.*, discussions on pages 15 - 17). By depicting the content of H<sub>2</sub>O and OH in these various TDS analysis drawings under the various conditions described in the Specification in relation thereto, the drawings in fact describe the detail regarding H<sub>2</sub>O and OH content essential for a proper understanding of the disclosed invention. For at least this reason, the objections set forth at item 2C on page 3 of the Office Action should be withdrawn.

**Amendments to the Specification:**

The Office Action repeatedly refers to amendments to the Specification filed April 15, 2002. This is incorrect. The last amendment filed in the present application was dated February 15, 2002. In the interest of moving the present application forward, all references to April 15, 2002 in the Office Action are assumed to be typographical errors by the Examiner, and the correct amendment date should have been February 15, 2002.

Items 3 and 4 on page 4 of the Office Action requested a substitute specification "because the numerous changes required by Applicant leads to extensive work on the part of the Office and

could lead to errors in the printing of the patent." Note that there are only **two** amendments (namely amendments dated February 14, 2001 and February 15, 2002) which must have been entered in the present application, despite the present Office Action objections to the amendments filed February 15, 2002. A substitute specification, if necessary, will be provided upon identification of allowable subject matter.

The Applicants submit that no new matter was introduced by prior amendments. Each specific instance of alleged new matter set forth in the Office Action will be addressed below.

(A) Page 16, lines 4 - 5

Item 5A on pages 4 - 5 of the Office Action objected to the amendment on page 16, lines 4-5 that changed N<sub>2</sub>O to SiH<sub>4</sub>. The Examiner alleged that this change constitutes new matter because "other source gases could have been intended and/or that since H<sub>2</sub>O in the oxide is germane to Applicants' invention, that perhaps Applicants' ratio was concerned with the H<sub>2</sub>O in the source gas."

It is submitted that the Examiner's interpretation is unreasonable and contradicts the bulk of the disclosures. For instance, page 15, lines 10 - 14 of the original specification clearly describe various experiments in which plasma CVD processes conducted in a parallel-plate-type plasma CVD apparatus while supplying SiH<sub>4</sub> and N<sub>2</sub>O as the gaseous source materials. Figures 3 - 14 show the result obtained by a TDS analysis for these plasma CVD processes (*see e.g.*, page 14, lines 33 - 37; as well as page 15, lines 14 - 19 of the original specification). The discussion for each figure also refers to similar plasma CVD processes for deposition SiO<sub>2</sub> films on a Si substrate (*see e.g.*, pages 15 - 17 of the original specification).

Moreover, in every discussion using the phrase "ratio of N<sub>2</sub>O," the discussion refers to the ratio of N<sub>2</sub>O with respect to SiH<sub>4</sub> (see e.g., page 16, lines 19 - 20; page 17, lines 26 - 27; and page 18, line 18 of the original specification). It is clear that page 16, line 5 was a typographical error and was clearly intended to refer to the ratio of N<sub>2</sub>O with respect to SiH<sub>4</sub> in the gaseous source. Accordingly, the objection at item 5A on pages 4 - 5 of the Office Action should be withdrawn.

(B) Page 15, line 27

Page 15, line 27 was amended to correct 200°C to 200W. The Examiner contended that this constitutes new matter alleging that the amendment paragraph could be interpreted to refer to temperatures. The Examiner's interpretation to support an allegation of new matter contradicts the bulk of the description in the disclosure, as well as contradicts the context for the change in the paragraph on page 15, lines 24 -29.

The change is to the phrase "under a conventional plasma power of 200°C immediately after the start of the heating." In all other instances referring to plasma power, a value is described in terms of W (not °C). More importantly, the only reasonable interpretation for that sentence is to refer to plasma power, since the following sentence refers to the relevant temperatures involved. Therefore, support exists in the original specification for the correction, and the only reasonable interpretation clearly indicates that an apparent typographical error was made on page 15, line 27. For at least these reasons, the objection at item 5B on page 5 of the Office Action should be withdrawn.

(C) Page 16, line 25

Page 16, line 15 was amended to correct H<sub>2</sub> to H<sub>2</sub>O. The Examiner alleged that this constitutes new matter because "H<sub>2</sub> gases in oxides is a major concern in the art and the rest of the sentence refers to Si-H bonds in the oxide." The Examiner's interpretation to support an allegation of new matter contradicts the context for the change, as well as the bulk of the description in the disclosures.

First, the reference to H<sub>2</sub> gas in oxides being a major concern in the art is irrelevant to the specific typographical error on page 16, line 15 of the present application. Second, the reference in the rest of the sentence to Si-H bonds in the oxide does not diminish the apparent typographical error basis for the change. This is clear from the fact that the sentence refers to the "foregoing decrease of H<sub>2</sub> and OH content in the SiO<sub>2</sub> film observed in the case of Figure 7." An inspection of the previous sentence clearly resolves any ambiguities as to what the "foregoing decrease" was referring to. In particular, the previous sentence states "as can be seen in Figure 7, the amount of H<sub>2</sub>O and OH incorporated into the SiO<sub>2</sub> film is reduced further as compared with the case of Figure 5." There is no ambiguity that the "foregoing decrease" on page 16, line 15 is referring to the decrease or reduction in the amount of H<sub>2</sub>O and OH incorporated into the SiO<sub>2</sub> film, as can be seen in Figure 7 (page 16, lines 12 - 14 of the original specification). When read in context, it is clear that there was a typographical error on page 16, line 15, and that H<sub>2</sub> should have been H<sub>2</sub>O. For at least these reasons, the objection at item 5C on page 5 of the Office Action should be withdrawn.

(D) Page 17, line 15

Item 5D on page 5 of the Office Action alleged that the correction on page 17, line 15 to change Figure 10 to Figure 8 allegedly constitutes new matter. This is incorrect. The original specification clearly supports the change. In particular, page 17, lines 15 - 16 clearly describe the drawing "in which the deposited  $\text{SiO}_2$  film has a reflective index of 1.63." The only drawing designated to have a reflective index of 1.63 is Figure 8 (*see* Figure 8 itself indicating  $\text{RI}=1.63$ ; as well as page 16, lines 19 - 26 of the original specification). Therefore, the reference to Figure 10 was clearly a typographical error and the change to Figure 8 is not new matter. For at least these reasons, the objection at item 5D on page 5 of the Office Action should be withdrawn.

(E) Page 20, line 15 and Page 27, line 12

Page 20, line 15 and page 27, line 12 were amended to change 50kW to 50W. It is submitted that this change has support in the original specification and does not constitute new matter.

First, the Examiner alleged that the Applicant referred to the "possibility" of setting the higher frequency power to less than 100W. Based on this, the Examiner concluded insufficient support for the correction. Second, the Examiner also alleged that the reference was to a generalized discussion appearing before the amended text, whereas the amended text described specific embodiments (alleging that it was not clear which one was in error). These allegations are unreasonable interpretations which contradict the bulk of the disclosures.

To clarify the record, the Applicant referred specifically to page 17, lines 24 - 25, claims 3 and 4, and the like (*see e.g.*, page 8 of the February 15, 2002 amendment). Referring specifically to

the cited passage in the specification (page 17, lines 24 - 25 of the original specification), it is clear that the discussion was to instances where it is *possible* to minimize the amount of H<sub>2</sub>O and OH incorporated into the underlying insulation film 6 of the semiconductor structure of Figure 2 . . ." The "possibility" mentioned by the Examiner does **not** pertain to the setting of high-frequency powers to less than 100W. On the contrary, the cited portion of the specification was referred to possibility of minimizing the amount of H<sub>2</sub>O and OH incorporated into the underlying insulation film 6 in certain instances. This possibility of minimized quantities of H<sub>2</sub>O and OH may be achieved "by setting the high-frequency power, used for a plasma formation, to about 100W or less when depositing the insulation film 6 by a plasma CVD process . . ." Therefore, the original specification clearly supports the reference to high-frequency power values to be "about 100W or less" as the appropriate range for minimizing the amount of H<sub>2</sub>O and OH. Therefore, to be consistent with this aspect of the present invention, the only reasonable interpretation of page 20, line 15 is to refer to a high-frequency power of something less than 100W, i.e. 50W and not 50kW which is clearly a typographical error. For at least these reasons, the objection at item 5E on pages 5 - 6 of the Office Action should be withdrawn.

(F) Replacement Paragraph at Page 16, Line 27

Item 5F on page 6 of the Office Action required the Applicant to identify support for the change of Figure 3 to Figure 4 in the replacement paragraph beginning at page 16, line 27, as well as to make a statement that no new matter was added.

First, the Office Action referred to amendment D, dated 3/1/01 paper number 19. There was no amendment filed on March 1, 2001. In the interest of moving the present application forward, the Applicants assume that the Examiner made a typographical error and that the correct reference is to the amendment dated February 14, 2001, as well as the amendment dated February 15, 2002, which submitted a replacement paragraph beginning at page 16, line 27, replacing the reference to Figure 5 at page 16, line 29 to Figure 4.

The typographical error in referring to Figure 5 on page 16, line 29 is clearly apparent upon inspection of Figure 9 itself, as well as the description in the original specification on page 16, lines 29 - 35. The paragraph beginning on page 16, line 27 refers to Figure 9. From Figure 9 itself, there is a clear indication that the relevant plasma power is 200W (see Figure 9 itself). In contrast, the plasma power for Figure 5 is at 100W. Therefore, Figure 9 cannot be the differential in which the result of Figure 3 is subtracted from the result of Figure 5 since the plasma power level of Figure 5 is not at 200W as clearly indicated in Figure 9. Moreover, the following paragraph describing Figure 10 shows the case in which the result of Figure 3 is subtracted from the result of Figure 5 wherein the frequency power *is* set to 100W. Figure 10 clearly indicates the high-frequency power being at 100W, which is consistent with the plasma power of 100W identified in Figure 5. Therefore, the prior description of Figure 9 cannot possibly be referring to Figure 5. Instead, to be consistent with the context of the remaining portion of the paragraph beginning at page 16, line 27, referring to Figure 4 and the plasma power of 200W, is to correct the apparent typographical error on page 16, line 29 to refer to Figure 4 (and not Figure 5). For at least these reasons, there is clear

support in the original disclosure for changing Figure 5 to Figure 4 on page 16, line 29. For at least these reasons, the objection at item 5F on page 6 of the Office Action should be withdrawn.

**Rejections Under 35 U.S.C. §103**

Claims 28, 29 and 33 were rejected under 35 U.S.C. §103 over the Applicants' admitted prior art (AAPA) in combination with **Toyotaka** (JP 07135208) and **Oda** (JP 6-20420). Claim 31 was rejected under 35 U.S.C. §103 over AAPA, **Toyotaka**, **Oda** and further in view of **Lage, et al.** (USP 5,485,420). Claims 34, 37, 38 and 41 were rejected under 35 U.S.C. §103 over AAPA, in combination with **Wolf** (Article entitled, "Silicon Processing for the VLSI Era") and **Oda**. Claims 35 and 39 were rejected under 35 U.S.C. § 103 over AAPA, **Wolf**, **Oda**, and further in view of **Lage**.

These rejections are substantially identical to those set forth in the prior final Office Action dated October 15, 2001. In response to the arguments submitted in the February 15, 2002 amendment, item 15 on pages 11 - 12 of the Office Action now identifies the alleged motivation to combine the cited references to support the §103 rejections.

In particular, the Examiner alleged that **Wolf** "clearly teaches the broader problem and solution of reducing H<sub>2</sub>O in all oxides in order to reduce OH charged traps." However, the Examiner did not identify any portion of **Wolf** in support of this allegation. On the contrary, a careful review of **Wolf** does not reveal any indication or suggestion of reducing OH charge traps. On the contrary, **Wolf** only appears to describe the conventional practice of forming a BPSG film over a silicon-

nitride layer which prevents dopants from the BPSG layer from diffusing into the substrate during the flow and re-flow of thermal cycles. This has nothing to do with the "broader problem and solution of reducing H<sub>2</sub>O in all oxides in order to reduce OH charge traps" as alleged by the Examiner. Please have the Applicant carefully review **Wolf** and confirm.

Item 15 on page 11 of the Office Action further alleged that **Wolf** provides the motivation to combine its teachings with other references "by pointing out on page 195, table 4.4, property 5 and 18, that a good oxide should not absorb or permeate moisture, in order to reduce charge trap densities, and reduce outgassing." However, nothing in the cited portion of **Wolf** appears to describe or address reducing OH charge traps. Property 5 identifies "no moisture absorption or permeability to moisture should occur." Property 18 "contains no residual constituents that outgas during layer processing to the degree that they degrade the properties of other layers of the interconnect system (e.g., outgassing from some polyimide films, SOG films or low-temperature TEOS films)." There is no apparent discussion here regarding reduction of OH traps nor the reduction of charge trap densities, as alleged by the Examiner.

Therefore, the Examiner is apparently relying upon facts within his personal knowledge in interpreting **Wolf**. Accordingly, the Examiner is respectfully requested to submit an Affidavit setting forth such facts in accordance with 37 C.F.R. § 1.104(d)(2). Otherwise, the Examiner should withdrawal the prior art rejections for lack of motivation to combine since such unsupported allegations is the classic application of hindsight using the present claimed invention as the blueprint for reading into prior art descriptions subject matter which do not clearly exist.

**Summary**

Nothing in the prior art, either alone or in combination, teaches or suggests each and every feature recited in the present claimed invention. In addition, no new matter was introduced by any of the prior amendments (of which only 2 were entered), as explained in detail above.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN & HATTORI, LLP



John P. Kong  
Attorney for Applicant  
Reg. No. 40,054

JPK/kal  
Atty. Docket No. **980268**  
Suite 1000, 1725 K Street, N.W.  
Washington, D.C. 20006  
(202) 659-2930



**23850**

PATENT TRADEMARK OFFICE